of the year are made light of, and the difficulties which the arid climate offers to the detailed examination of an extensive tract of such country have to be experienced in order that they may be fully appreciated H. G. L.

THE LAWES AND GILBERT CENTENARY FUND.

JUST a hundred years ago was born John Bennett Lawes, followed three years later by his life-long collaborator, John Henry Gilbert; together they carried on their scientific work until the end of the nineteenth century, and now preparations are being made to commemorate the year of Lawes' birth by rebuilding the laboratory in which so much of the pioneer work in agricultural science was done. The issue of the Annual Report on the Rothamsted Experiments reminds us of the historic claims of that institution to all the assistance the public can give it.

Lawes began his agricultural experiments so far back as 1838, but though those early essays led to the invention of superphosphate and so incidentally to the fortune from which he so liberally endowed the Rothamsted Station, the experiments, properly speaking, did not begin until 1842, when Gilbert became associated with them. From that time some of the famous fields began to take shape, and by 1852 had settled down to that scheme of manuring which has never since been changed; in consequence, the plots now supply data as to the effect of fertilisers both upon the crop and upon the soil which are not merely unrivalled in their trustworthiness, but are constantly being re-interpreted as the science of the nutrition of the plant develops. In 1855 the laboratory was built from subscriptions raised as a testimonial to the value of Lawes' work, and it is this laboratory, now out of date and becoming structurally unsound, that the Rothamsted Committee seeks to replace.

Lawes died in 1900, Gilbert in 1901, and that first long and honourable chapter in the history of Rothamsted was closed. With the appointment of a new Director, Mr. A. D. Hall, in 1902, came the desire for a fresh outlook upon the old experiments; new points of view had arisen, particularly the physical and biological aspects of the soil had become important. The first necessity was to get together a body of workers, for one man could no longer cover so complex a field, and to find adequate accommodation for them, because the arrangements of the old laboratory, though equal to the routine determinations which Gilbert needed, were extremely primitive. Unfortunately, the endowment of the Lawes' Trust provided no margin for extension; still the laboratory was reformed, a few voluntary assistants were secured and new ground broken. After a time Mr. J. F. Mason built a new wing for bacteriology and enabled Dr. H. B. Hutchinson to join the staff, and a little later the Goldsmiths' Company added to the endowment so that the services of Dr. E. J. Russell could be secured.

Up to that time no assistance came from Government, but with the creation of the Development Fund in 1910, the Rothamsted Station became recognised as the Institute for the investigation of the soil and the nutrition of the plant, and received an adequate endowment. The first result was that the Committee was able not only to add some experienced workers to the staff, but also to take a long lease of the home farm containing the classic fields and to embark upon the erection of an additional laboratory with all modern conveniences of electric supply, vacuum and air current, etc. At that point Mr. Hall resigned the Directorship, and was succeeded by Dr. Russell, who has no sooner got the new laboratory opened than he has set about the replacement of the old one which, even were it adaptable to modern methods of work, has for years been giving trouble owing to original defects in construction.

Subscriptions have been received from all parts of the world, the farming societies, large and small, in Great Britain, have contributed in a way that shows their increased appreciation of research, but nearly 1000*l.* are still wanted to complete the 6000*l.* that it is necessary to raise from the public. The laboratory is expected to cost 12,000*l.*, towards which there is reason to expect the Development Commissioners will give a sum equal to that raised from other sources, so now is the time for everyone interested in the welfare of this *doyen* of institutions for agricultural research to send along their donations from which the Rothamsted Station will reap a double benefit.

THE LIFE-HISTORY OF THE EEL.[1]

MANY articles in NATURE have dealt, during recent years, with the above subject; but its interest is not exhausted, and we here welcome the appearance of three new contributions to the long-debated question of the eel.

Dr. Grassi's work is the first publication of the Italian Royal Commission on "Thalassography," and in these first-fruits the commission gives promise of a great return from its systematic exploration of the Mediterranean Sea. Mr. Lea's paper is one of the many beautiful and interesting monographs which have already been based on the collections made by Sir John Murray and Dr. Hjort in the deep waters of the Atlantic. Dr. Bowman's paper is a brief but interesting note, based on the work of the Scottish research vessel *Goldseeker*.

In a long and learned introduction Dr. Grassi relates the history of our knowledge of the life-history of the eel; and while this history has been often summarised, it is here told more completely than ever. Dr. Grassi goes back even to Aristotle, and, telling us that the Sicilians still call the larval eels *casentule,* that is, "earthworms," while the philosopher tells us that the eels spring from "earthworms," *γης ἔντερα*, he inclines to the conclusion that Aristotle knew a deal more about the biology and development of the eel than is actually set forth in his brief recorded references. It was Redi, in the seventeenth century, who showed, with the utmost clearness, that the eels breed out in the open sea, after migrating down the rivers "nel rimpunto della luna," "in the dark of the moon."

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[1] "Metamorphose der Muraenoiden: Systematische und Oekologische Untersuchungen "(Text Italienisch). By Dr. Battista Grassi. Pp. x+211 +xv plates. (Jena: Gustav Fischer, 1913.) Price 50 marks.

"Muraenoid Larvae from the *Michael Sars* North Atlantic Expedition, 1910." By Einar Lea. In vol. iii. of the Scientific Reports of the Expedition. Pp. 59+6 plates. (Bergen: John Grieg, 1913.)

"The Distribution of the Larvae of the Eel in Scottish Waters." By Alexander Bowman, D.Sc. Fishery Board for Scotland, Scientific Investigations, 1912, No. II (December, 1913).

Another chapter of the story opens, just 150 years ago to a year, when a certain Mr. William Morris sent to Pennant, from Holyhead, the curious little fish which, in our youth, we used to read of in "Yarrell," under the name of the "Anglesey Morris," or *Leptocephalus morrisii,* as Gronovius had called it. Other similar fishes were from time to time described, until in 1856, Kaup, in a British Museum catalogue, described a number of species, including a certain *L. brevirostris*, from the Straits of Messina. A multitude of naturalists dealt, during the early part of the last century, with these little fishes. Cuvier said that their study was "une des plus intéressantes auxquelles les naturalistes voyageurs puissent se livrer." Johannes Müller, with splendid insight, declared that they were closely allied to the Murænoids. Carus, in 1861, suspected that they were larval forms of some other fish, perhaps Cepola or Trichiurus, and in 1864 Dr. Theodore Gill asserted that these little Leptocephali were but larval eels, a fine instance of zoological prescience.

A long controversy followed, in which Günther and others maintained that the Leptocephali were not an ordinary necessary stage in the life-history of the eels, but were abnormal larvæ, distorted by an unnatural habitat. At length it was made clear by Dareste, Moreau, and finally and experimentally by Delage, in 1886, that *Leptocephalus morrisii* was the normal larva of the conger. Here begins the series of researches by Grassi and Calandruccio, who between 1892 and 1905 confirmed Delage's account of the metamorphosis of the conger, showed that Kaup's *L. brevirostris* was the larva of the common eel, studied in detail the life-history and metamorphosis of a whole series of other Leptocephalids, and maintained that these little larval fishes were inhabitants of the deep waters, from which sometimes, as in the Straits of Messina, they were brought up to the surface by currents or by whirlpools; just as Yarrell told, long before, of a specimen cast up in the eruption of Graham's Island in the Mediterranean. As was foreseen by Salvatore Lo Bianco, in 1891, the larvæ of the common eel are inhabitants of the deep sea, and three years later Johan Petersen captured the Leptocephalus of the common eel, *L. brevirostris,* out in the Atlantic, south-west of the Faeroe Islands. From that date onwards, together with Prof. Grassi himself, a band of Scandinavian naturalists—Petersen, Hjort, with his pupil Einar Lea, and last but not least, Dr. Johann Schmidt—have carried on the investigation of the metamorphosis and migrations of the eel.[2] Schmidt, Hjort, and Lea have now shown that the main breeding-place of the eel is not only out in the open Atlantic, but is in all probability in the warm and very salt waters of the southern part of the North Atlantic, south and west of the Azores; and an interesting part of Mr. Lea's paper is one in which he discusses the probable duration of the eel's long voyage to its breeding-place, and of the slow return of the young larvæ home. This point is further elucidated by Dr. Bowman, who is able to trace the Leptocephali of the common eel on their way round the west and north of Scotland from about June to August, while by November or December they appear as "elvers" off the coast, and are ready to ascend the rivers in March or April. The Leptocephali of the conger are found off the east coast from December to May.

But there still remain a few points of doubt, and therefore of controversy, on which the learned Italian naturalist and his Scandinavian brethren do not quite agree. These are questions which we would not lightly judge or prejudge, and we may simply say that Dr. Grassi seems to state his case with great fairness, and with a very open mind. Among the points still at issue we may mention two. First, does the eel breed in the Mediterranean? And secondly, are the Leptocephali (at least those of the common eel) inhabitants of the surface-waters, of the bottom, or of intermediate depths? Dr. Schmidt believes that the eel does not propagate at all in the Mediterranean, "conclusione molto sorprendente," as Grassi calls it. He holds that for the Mediterranean eels, as for all those of western and northern Europe, the Atlantic is the one great breeding-ground, and that inwards, through the Straits of Gibraltar, pass the migrating young; while Dr. Grassi still inclines to his old belief that the deeper parts of the Mediterranean are also breeding-grounds. At considerable length Dr. Grassi discusses the other problem, and holds that it is by no means proved, as Dr. Schmidt would have it, that the Leptocephali are dwellers in the upper layers. He refers to the habit, which many species at least of the Leptocephali have, of burrowing in the sand or hiding under stones; he states that he has seen *L. brevirostris* itself actually doing so; and he tells us that in captivity the little Leptocephali avoid the light, and retreat into dark corners of the aquarium. In short, he is unwilling to budge from his old opinion, set forth twenty years ago, that the Leptocephali come only occasionally towards the surface from the great depths which constitute their natural home.

The question is curiously interlinked with the too little-known habits of the sunfish, *Orthagoriscus mola*. Multitudes of Leptocephali are found within the stomach of that fish, and would even seem to constitute its main, though not exclusive, nutriment. Sometimes, and this in itself would seem rather to tell against Prof. Grassi's view, they are still actually living when the fish is caught and its stomach opened. Now the sunfish is often seen upon the surface, and is harpooned or otherwise captured there; but Prof. Grassi will not admit that this is its normal habitat, but thinks that it only now and then comes up from the greater depths. This is not the usual belief, but it was Lo Bianco's, as Grassi tells us, and Lo Bianco's opinion carries a deal of weight. After all, then, the sunfish may be a denizen of the deep waters, like *Lampris luna*. But, in the few cases where a sunfish has been found to contain other diet than Leptocephali, the stomach was found full of Salpæ, pteropods, and Velellæ, and they had doubtless been fed upon, if not at the surface, at least in the upper layers. If we may at all venture an opinion, Dr. Schmidt seems to have the better of the argument. A minor but curious question is how the sunfish, with its tiny mouth and apparently awkward body, is able to catch, by hundreds and by thousands, these little active, transparent Leptocephali.

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[2] See Dr. Schmidt's article in Nature, August 22, 1912; also Dr. Johann Hjort's communication to Nature of November 24, 1910.

D. W. T.

CARTE INTERNATIONALE DU MONDE AU MILLIONIEME.

THE conference of London, which assembled at the Foreign Office in November, 1909, at the invitation of the British Government, drew up an elaborate code of rules for the construction of an international map on the scale of one in a million. In the four years which have passed since that meeting about a dozen sheets in all have been completed, though not so many have been published. It had soon become evident that a second conference was required for two reasons. Certain of the resolutions of London worked badly in practice, and needed modification; while several of the Governments which would be called upon to undertake a considerable share of the work had not been represented in London, and desired to be heard before committing themselves to the scheme.

The second international conference met in Paris, at the invitation of the French Government, in December last, and thirty-three countries were represented by delegates officially nominated, whose resolutions will be submitted to their respective Governments for formal ratification. This official character of the meeting has much practical importance. The scheme had been discussed at successive meetings of the International Geographical Congress for twenty years; it remained inoperative until the first official conference of 1909.

The first business of the Paris meeting was to decide what parts of the London resolutions should stand unchanged, and what was open to discussion. A prompt decision to leave as much as possible untouched cleared the way for the real business of the meeting, which resolved itself into three parts—the revision of the conventional signs; the improvement of the colour scale for the layers, and other details of the representation of relief; and the distribution of the sheets which covered the territory of several Powers. The three commissions which were nominated to deal with these questions chose as their presidents Prof. Penck, Colonel Thiébaut, of the *Service géographique de l'armée*, and Colonel Close, respectively. General Bourgeois, chief of the *Service géographique*, presided over the full conference with admirable firmness and lucidity.

The work of the first commission involved long meetings and animated discussion on the classification of towns and the spelling of place names, which affect different countries in very different ways. A system of town classification which is good for Europe is hopeless for Africa, while the relative claims of population and administrative importance lead to difficulties on a single sheet. The spelling of place names in Eastern Europe is fiercely contestable; the transliteration of African names into European equivalents produces endless trouble on boundary sheets. On these matters no hard and fast agreement was possible; much must be left to the discretion of the establishment that makes the sheet. Minor difficulties in the classification of railways, navigable rivers, and roads were amicably adjusted, and the resulting conventional signs sheet is in many respects a great improvement on that adopted four years ago.

The work of the second commission was very much simplified by the production of experimental variants of the Istambul sheet, which had been prepared by Colonel Hedley in the Geographical Section of the General Staff. Fine black contours, instead of brown, were accepted without difficulty. The ugly and unsatisfactory upper tones of the London colour scale for layer tints found few defenders, and it was not difficult to substitute a scale running into orange and red in place of the old brown and magenta. Above the snow line the layer tint is to be omitted; glaciers are to be distinguished by blue form lines or hachures, and there is liberty to use shading when the contours are not sufficient to bring up the form of the snow peaks. In principle the contour interval is, as before, 100 metres throughout; but this is not always feasible, while the suppression of contours at discretion leads to unnecessary diversity. The remedy was to declare certain contours obligatory (*courbes maitresses*), the others being discretionary.

The third commission laid down the principle that the right to produce a sheet belonged to the country which owned most territory within its limits, and refused to make any pronouncement as to sheets lying wholly in territories which have no cartographical establishments. The significance of the latter decision was lessened by the announcement of the Chinese delegate that topographical establishments were now in active operation in all the provinces of the Republic. The delegates of the South American States came to an important agreement among themselves in regard to the representation of doubtful boundaries.

In the full sessions the decisions of the com